

# **Diverse preferences over publicly provided goods and the limits to redistribution**

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## ***Preface***

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*All the remaining errors are my own.*

*Lin Ling*

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# 1. Introduction

The political economics studies always face a “redistribution puzzle”. In many societies, the income distribution is skewed to the right, which means the majority get an income lower than the mean. The political implication dealt from the standard electoral model shows that the majority poor would expect a large extent of redistribution by imposing high tax rate or spending more money on public goods or directly to the poor. However, many empirical studies have showed little support for this case, and some scholars even found the opposite result about it. Large extent of redistribution is always corresponding with low level of social inequality (Harms and Zink 2003, Lind 2005, Lind and Rohner 2008, Moene and Wallerstein 2001).

The purpose of my thesis is to discuss the extent of redistribution in a democratic society. Why is the extent of redistribution usually lower than the one predicted by the slandered political model? What are the factors that can determine the extent of redistribution? I especially focus on how people’s diverse preference affects the extent of redistribution and examine the case in presence of privately provided public goods. Throughout my thesis, unlike the standard model in which every individual treats the public goods as equal, I focus on people’s diverse preference for publicly provided goods. For instance, some rich people may less prefer publicly provided health service (may be due to low quality), and they turn to buy it in the private market if it is available there. So those people may benefit less from a policy that adopts to spend a lot on the social health system. Thus, it may result in low willingness to pay tax for the publicly provided good.

The standard model predicts that in an electoral equilibrium, all parties converge to the policy that preferred by the pivotal voter. In the standard model, the pivotal voter is the voter with the median income. I introduce a new parameter that captures individual’s diverse preference over the publicly provided good. That can explain people’s different willingness to pay for the public good, which in turns affects the redistribution policy in electoral competition. In my model, the pivotal voter is no longer the voter with the median income. As I parameterize people’s intention to consume the publicly provided good, I find a new term for the pivotal voter. My analysis shows that the distribution of ratio of income over the intensity to consume the good for any individual is an important determinant of the electoral outcome.

We further extend our argument to the situation in which the government is not necessarily the only supplier of the publicly provided goods. Most of the standard models consider the government as a sole distributor of the public good. Unlike these models, we consider the existence of a private manufacturer who sells a substitute of the public good. The good supplied by the private manufacturer could be different from the publicly provided good in various dimensions. In this analysis, I assume that they differ in quality. Some people will then turn to consume the good in the private market due to the different quality. In equilibrium, the quality provided by the private manufacturer is higher than the quality provided by the government; otherwise no individual will purchase the good from the private market. However, the manufacturer charges a price for quality. I characterize the equilibrium level of quality supplied by the private manufacturer and the government, and the tax rates that arises in electoral competition. I find that the existence of privately provided public goods may further limit the willingness to consume publicly provided good. The argument is based on the following intuition. Low willingness to consume the publicly provided good result in low willingness to pay taxes to support such programs, which leads to low quality of the publicly provided good, and further reduce the willingness to consume the publicly provided good.

The thesis is organized as follows. Section 2 provides a brief literature review. The interaction between social inequality and extent of redistribution has been examined by several scholars. In my thesis, I discuss various related papers and theories. The standard model predicts a positive relationship between income inequality and extent of the redistribution, which turns out not robust in many empirical studies. Several other papers tried to explain this apparent limit to the extent of redistribution through different approaches. In section 3, I introduce framework of the model which is developed from the standard political model (Persson and Tabellini, 2000). I modified an individual's utility function by introducing a new variable that describes individual's intention to consume the good. In section 3.3, I discuss the framework of a simple electoral competition. In section 4, I analyze the model. Utilizing the single crossing property of individual preferences, I characterize the form of pivotal voter. The position of the pivotal voter is affected by the people's intention to consume the publicly provided good. In the equilibrium, all parties converge to the policy preferred by the pivotal voter in order to maximize their probability of winning. I calculate the first best tax rate and compare it with the equilibrium result I get from the electoral competition, and see how far

the distance between these two. Section 4.5 is the comparative statics on people's intention for consuming the publicly provided goods. In section 5, I extend the model by taking the quality of the public goods as an endogenous variable into account. The good provided by the private manufacturer can be considered as a substitute of the good provided by the government. In this section, I study how individuals make the choice between these two markets. How many people in proportion of the whole population will choose the good supplied by the private manufacturer, how the private manufacturer and the government determine the quality of the good they provided respectively, how the price of the good in the private market is formulated, and what is the equilibrium tax rate in this circumstance. Finally, I conclude with a summary of the main findings in the last section.

## 2. Literature review

In poor and unequal societies, the income distribution is typically skewed to the right, which means that a majority of the individuals earns an income that is strictly lower than the mean. From the economic models of Romer (1975), Roberts (1977), and Meltzer and Richard (1981), the conventional view is that increased inequality in pre tax earnings leads to greater political demand for redistributive policies, for instance, imposing high tax rate or directly (indirectly) transfer to the poor. The logic is simple and compelling. If the majority of the individuals receive a below-average income and if an increase in inequality causes above - average incomes to rise and below-average incomes to fall, then it is reasonable to think that demands for public policies to reduce the gap between the rich and the poor will increase. However, empirical studies, showed weak support for the prediction from above theories, some researches even shows larger extent redistribution in unequal societies than in more equal societies. (Jo Thori Lind, 2005; Perotti, 1996; Moene and Wallerstein, 2001,2003)

Let's start from the basic model imposed by Persson and Tabellini (2000), which give us a theoretical prediction of large scale of redistribution. In this model, each individual receives an exogenously given pre tax income  $y$ , and assume that the median income is below the mean income, so the distribution of income is skewed to the right. The government collects tax from each individual to provide publicly provided good with exogenous quality. And all the individuals are assumed to have the same preference over the publicly provided good. Neither the government spending nor the tax rate can be targeted to specific voter or group. And the policy preference therefore become monotonic in the one parameter which distinguishes individuals, that is the relative income. Voters' utility is described in terms of the sum of the consumption for both private good and publicly provided good. Individual's only objective is to maximize his own utility, and then they get a negative relationship between inequality of income and tax rate. According to the electoral competition, in the equilibrium case all the candidates converge to the policy preferred by the voter with median income (the median voter).

Given the basic model, a number of scholars have attempted to derive extensions to the model so it can give a better picture of the reality. In the following of this section I will review some theoretical approaches to explain the apparent limitation of redistribution.

Lind and Rohner (2008) introduce a new mechanism by taking an unequal distribution of political knowledge into account. They relax the assumption in the standard models of Downsian electoral competition that the electoral platform of the parties can be perfectly observed, and build a model where voters receive a noisy signal of electoral platforms. The higher the level of political knowledge of a given voter, the less noisy of his signal and the more accurately the electoral platforms of the parties are perceived. The model further introduces an underlying variable, education, which positively affects personal income and level of political information. Voters with different education level will have different income as well as the intensities to acquire the political knowledge, hence rich voters are better informed. In these circumstances, the redistribution level is below the level predicted by the standard median voter models of Downsian electoral competition under full information. The rich voter who prefers the less extent of redistribution will get more accurate political information about the party's platforms, and according which select more often parties that are in their own economics interest. Therefore, it causes the result that the rich voter get more and more political weight which makes them more possible to achieve their favored policy. On contract, people with lower income probably get less accurate information and will be valued less and capture less concern in the political competition. Therefore, the parties will converge to the policy favored by the rich people and implement less or low level of redistribution. The authors validate their prediction from data obtained from American National Election Studies. Lind (2007) also points out that it is a too simplistic way to value the political behavior when only takes voter's own post tax income into account since most voters have a broader view on the consequences of the implemented policy. Lind (2007) models voters as having a social conscience and do this along the line where voters maximize a weighted sum of their own utility and utilitarian social welfare, and in this case, the median voter is still the voter with median income. However, his preferred tax rate depends generally on the weight.

Another explanation takes social issue into account for the lack of positive relationship between the income inequality and the redistribution level. Giacomo and Hans (2000) introduce the social limits to explain this phenomenon. The paper especially shows the limits to the redistribution may rise when economic inequality has an informational value for social decisions. Thoms Scitovsky (1976) interpret that many goods and decisions that heavily affect individual's quality of life are not allocated or made through market but through social interactions. These kinds of good can be captured, for instance, how people are treated by



others, or over whom they mate with, which are not the object of market transaction. As shown by Harold Cole et al (1992), the existence of social competition for some goods can endogenously generate a concern for relative position in the income distribution. When information about the relative income is private, individuals will be interested in the observable consumption differentials between them and their social competitors. Since consumption differentials are influenced by redistributive taxation, the political attitudes of people towards redistribution will be shaped by its expected impact on social competition. In some identifiable environment, this concern for social success may be the crucial factor that limits the extent of redistribution desired by a majority of voters. In order to highlight the role of social competition, Giacomo and Hans model the social competition as a pair wise voluntary matching game. An individual's matching value for instance, his desirability as a social partner, is assumed to be positively related with one's own endowment and gross income. In this assumption, the richer individual can quite naturally be thought of as being in a better position to get endowment with matching value. Melvin L. Kohn (1969) gets the sociological and psychological evidences supporting the view that higher educational level and job self direction, both of which are correlated with income, are also correlated with the ability to provide pleasant stimulation to social contacts. The relationship between wealth inequality and redistribution taxation in the presence of social limits may significantly differ from the standard political model. While pecuniary incentives make the middle class willing to increase the extent of redistributions, pre-tax inequality increase, social incentives may push in the opposite direction. In this model, more inequality, as measured by the difference between the wealth of the rich and that of the poor, tends to lower the extent of redistribution desired by the middle class. With respect to middle-class individuals, pre-tax inequality is shown to raise the loss in the social sphere that is inflicted upon them by a marginal tax increase. Hence, increasing the inequality increases the aversion of the middle-class towards the redistribution and leads to a more conservative tax system.

In some other literatures, the role of expectation about the future in determining individual's attitudes towards redistribution was emphasized. Hirschman (1973) in his classical paper suggested optimistic expectations about future income prospects may make agents tolerate current inequality. Bénabou and Ok's (2001) "Prospect of upward mobility" (POUM) hypothesis essentially says that although a majority has income below average today, it could be that a majority rationally expect to have income above average next period. If policies are sufficiently persistent, this could lead voters with income below average, who in the standard

model would benefit from higher taxes, to oppose taxes as their gain today is less than their loss next period. The crucial assumption for these expectations to be rational is that the income transition function, i.e. the map between income today and income next period, is concave. This means that expected income increases are larger if you are poor than if you are rich. The argument is formalized in the following way. Every individual lives in two periods, in the first period, individuals receive incomes  $y$  according to some distribution with mean  $\mu$  and median  $m$ . As usual, we assume that  $m < \mu$ .  $f$  is called the transition function and assumed to be concave. Then an individual with income  $y$  in this period receives  $f(y)$  next period. For simplicity assume that the agent with mean income in the first period maintains his income, so  $f(\mu) = \mu$ . However, he will not be the person with mean income next period. So  $E f(y) < f(Ey) = \mu$ . This implies that there is a group of voters with income today below  $\mu$  who believe they will get income above  $E f(y)$  next period. This group may in theory include the median voter, who would then oppose redistribution. B'énabou and Ok (2001) also show that a similar reasoning holds if we allow the transition process of incomes to be stochastic and when we have more than two periods. One way to describe this approach is to say that they show that the American Dream under some conditions may be rational. Particularly, the more concave the transition function is, the easier it is that the median voter expects to have income above the average in the future. There is quite good empirical support for the hypothesis that expectations about a higher income affects preferences for redistribution (Alesina and La Ferrara 2005, Lind 2007, Ravallion and Lokshin 2000). Whether these expectations are rational, however, is not so easy to test. But there seems to be an effect that those who believe their economic situations are going to improve actually have higher income at the next election year (Lind 2007). Furthermore, Piketty (1995) emphasizes the role of learning about social mobility in determining people's attitude towards redistribution. He assumes that agents' beliefs about whether birth or individual effort is decisive for economic success are determined by past family experience. As a consequence, agents whose ancestors experienced social mobility believe that they may move up the social ladder themselves, and societies with a tradition of social mobility should therefore be characterized by a higher tolerance for inequality.

In the basic model, the transfers are universal and lump sum. In most modern welfare states, however, targeting of disadvantaged groups, particularly through social insurance, is an important feature. As some gain more than others from such schemes, the pattern of support for high spending is altered. Moene and Wallerstein (2001) demonstrate that a more complete

theory leads to different conclusions. Support for some kinds of welfare spending may increase as inequality rises, but support for other kind is lower when inequality is higher. In particular, the model implies that greater inequality in pretax earnings is associated with less, not more, spending on welfare policies targeted to people who have lost their market income because of layoffs, accidents, or ill health. The model shows that increased inequality increases the median voter's preferred level of redistribution if redistribution targets the employed, but reduces his support if redistribution targets the unemployed. If the fraction of targeting and the total size of transfers are endogenous, which they model as a two step voting procedure, they find that increased inequality reduces the politically chosen size of transfers if initial inequality is below a certain threshold. Increased inequality has two effects in their model. First, as increasing inequality reduces the median voter's income, it increases his demand for universal redistribution exactly as in the standard model. But in their model, transfers also serve as insurance against income losses. And as insurance is a normal good, reduced inequality reduces the demand for insurance. When initial inequality is below the threshold, the second effect dominates, and increased inequality reduces the support for redistribution. The model investigates the contrast between the redistributive and the insurance views in terms of how inequality affects political support for welfare spending. Consider an increase in income inequality that lowers the income of the median voter but leaves mean income unchanged. In the redistributive model, the wider this gap, the more the median voter gains from welfare expenditures. In the insurance model, in contrast, the demand for insurance declines with income, holding risk constant, assuming that insurance is a normal good. If median-voter income decreases and the risks covered by social insurance do not change, and then support for spending on social insurance will decline. From the standard model, voters were voting over tax levels directly. According to Downs's electoral competition, both parties propose platforms to maximize their probability of winning the election. We then have the result that both parties will converge to the platform corresponding to the median voter's preferred policy. However, a crucial assumption for this to hold is that tax policy is the only policy. Roemer (1998, 1999, 2001, 2004) have explored this restriction of the assumption in case of multidimensional politics. In Roemer's model, all political parties are assumed to consist of three types of factions—opportunists, militants, and reformers. Opportunists' objective is solely to maximize the party's vote share in an election; militants seek to announce (and implement) the preferred policy of the average party member; and reformers have an objective function that is a convex combination of the objective functions of the opportunists and militants. It has been shown that the existence of reformers has no

effect on what policies the party announces. With two parties, a pair of policy announcements constitute a political unanimity Nash equilibrium (PUNE) if and only if the reformers and militants of any given party do not unanimously agree to deviate from their announced policy, given the policy put forth by the other party. In other words, if a pair of policies constitute a PUNE, then it should not be the case that both factions of a party can be made weakly better off (and one faction strictly better off) by deviating from the policy that they put forward. Such unanimity to deviate can be rare, and thus PUNEs are more likely to exist than regular Nash Equilibrium. Although there are no known cases where PUNEs do not exist, no simple necessary and sufficient conditions for the existence of non-trivial PUNEs have yet been offered. (A nontrivial PUNE is one in which no party offers the ideal policy of either its militants or opportunists.) The question of the existence of non-trivial PUNEs remains an important open question in the theory of political competition.

### 3. Framework

#### 3.1 General framework with exogenous quality

As in the standard political economics model (Persson and Tabellini, 2000), each voter has the same preference over the publicly provided goods and the government spending is provided in the same amount to every individual in the society. I differ from the standard model by introducing heterogeneous preference over publicly provided goods, which affect individual's consumption decision and the total utility he will be obtained. Throughout my model, we consider a consumption good, which would be provided by government and individuals have heterogeneous preference over the intention of consumption. This kind of good, for example, included education, health services, unemployment insurance etc. At the first part of our analysis, we will consider the case in which the government can only provide the goods, and the cost is collected through direct taxation. Hence, the consumption good is treated as a publicly provided good. At the next part, we will consider the case in which the good is also supplied by a private manufacturer at a price. In the latter case, we differentiate the publicly provided good from the privately provided good in terms of quality.

Let's consider a society with a continuum of population of size 1, citizens with different types indexed by  $i$ . Income varies across individuals, each agent gets an exogenous pre tax income  $y$ , and we denote income of individual  $i$  by  $y^i$ . Each individual consumes two types of goods. One component of consumption is publicly provided, we call it  $g$ , and the other component is privately provided and denoted by  $m$ . Provision of  $g$  will be financed by the government through direct taxation.

#### 3.2 Individual's Utility

We assume that citizens have different preferences towards the public goods, each individual has a utility function of the following form

$$w^i = c^i + \alpha^i H(g)$$

Individual's utility is combined by two components, the first term  $c^i$  describes the consumption for the private good, and the last term  $\alpha^i H(g)$  captures the utility from consuming the public good. Here  $\alpha^i$  is denoted as the individual  $i$ 's intention to consume the public goods. And  $H(\cdot)$  is a concave and increasing function which describes the utility derived from the public goods and  $g$  captures the amount of public goods.  $H(\cdot)$  is an increasing function of

$g$ , and the marginal utility is decreasing. We have the properties of this function  $H_g > 0, H_{gg} < 0$ .

The private goods consumption can be written as

$$c^i = (1 - \tau) y^i$$

Denote  $\tau$  as the tax rate ( $0 \leq \tau \leq 1$ )

Budget constraint

The government spending was financed by the tax revenue and it will cause a cost  $\theta$  for the government to provide the public goods. We assume that in order to provide  $g$  amount of public good, the government has to incur a cost of  $\theta g$ . So the government budget constraint is simply then

$$\begin{aligned} g + \theta g &= \tau y \\ \Rightarrow g &= \frac{\tau y}{1 + \theta} \end{aligned}$$

Where  $y = \int y^i dF$  denote the average income ( $F$  is the population distribution, with the population size normalized to 1, the average income is equivalent to aggregate income).

### 3.3 Electoral framework

We consider a two-party electoral competition in a representative democracy. Throughout the electoral competition game we are about to tell, there are two assumptions should be made clear. (Persson and Tabellini, 2000)

First, all the candidates are opportunistic, which means their only objection is winning the election, what policy is implemented is none of their concern, because their benefits from holding the office is exogenously given and independent from the policy.

Second, the candidates commit to the well-defined policy ahead of the elections. Electoral competition is viewed as a choice of location by two competing parties. The parties announce their electoral platforms to maximize their winning probability, the voters vote for their preferred policy, and the elected party implements their announced policy afterwards.

General framework of the election

The game includes two political parties  $P$ ,  $P \in \{A, B\}$ . Each of them maximizes their expected value of some exogenous rents.

The timing of the electoral event is as follows:

1. Both of the candidates simultaneously and non-cooperatively announce their electoral platforms  $g_A, g_B$ .
2. Election is held, and the voters vote for either of the candidates according their preferred policy.
3. The elected candidate implements the policy which he announced before the election.

## 4. Analysis

### 4.1 individual preferred tax rate

Given above preliminaries, we rearrange the utility function as

$$\begin{aligned} w^i(g) &= (1 - \tau)y^i + \alpha^i H(g) \\ &= \left(1 - \frac{(1 + \theta)g}{y}\right)y^i + \alpha^i H(g) \end{aligned} \quad (1)$$

Every individual seeks to maximize his own utility

We differentiate equation (3) w.r.t.  $g$

$$-\frac{(1 + \theta)y^i}{y} + \alpha^i H_g(g) = 0$$

Which yields individual  $i$ 's most preferred policy

$$g^i = H_g^{-1}\left(\frac{(1 + \theta)}{y} \cdot \frac{y^i}{\alpha^i}\right)$$

Here we define a new variable

$$z^i = \frac{y^i}{\alpha^i}$$

and let's call it income-intention ratio. Consider the crucial role played by  $z^i$ , in the Persson and Tabellini's model, individual's preference is monotonic according different relative income ratio  $\frac{y^i}{y}$ , however, the parameter distinguish individual's preference is now the income-intention ratio, which reflect the assumption that individual has different willingness to consume the publicly provided goods.

### 4.2 First best tax rate

When we come to the first best tax rate, we need to find out the aggregate welfare of the whole society. Here we simply sum up all the welfare of all the citizens.

$$w = \int_{y^i} \int_{\alpha^i} w^i(g) dG dF$$



by (1)

$$\begin{aligned}
&= \int_{y^i} \int_{\alpha^i} \left(1 - \frac{(1+\theta)g}{y}\right) y^i + \alpha^i H(g) dG dF \\
&= \int_{y^i} \left\{ \int_{\alpha^i} \left(1 - \frac{(1+\theta)g}{y}\right) y^i + \alpha^i H(g) dG \right\} dF
\end{aligned}$$

Note we assume  $\alpha$  is a continuous variable and denote the distribution of  $\alpha^i$  by  $G$ .

We calculate the above expression in the following way

First keep  $y$  fixed and integrate

$$\left(1 - \frac{(1+\theta)g}{y}\right) y^i + \alpha^i H(g)$$

w.r.t.  $\alpha$ . Which yields

$$\begin{aligned}
&\int_{\alpha^i} \left(1 - \frac{(1+\theta)g}{y}\right) y^i + \alpha^i H(g) dG \\
&= \left(1 - \frac{(1+\theta)g}{y}\right) y^i + H(g) \bar{\alpha}
\end{aligned}$$

Where  $\bar{\alpha} = \int_{\alpha^i} \alpha^i dG$ , denote the expected value of  $\alpha$ .

So

$$\begin{aligned}
w &= \int_{y^i} \left(1 - \frac{(1+\theta)g}{y}\right) y^i + H(g) \bar{\alpha} dF \\
&= \left(1 - \frac{(1+\theta)g}{y}\right) y + H(g) \bar{\alpha} \\
&= y - (1+\theta)g + H(g) \bar{\alpha}
\end{aligned} \tag{2}$$

Maximize the aggregate welfare of the society by differentiating (2) w.r.t.  $g$  and equating it to zero, we get

$$-(1+\theta) + \bar{\alpha} H_g(g) = 0$$

$$\Rightarrow H_g(g) = \frac{1 + \theta}{\bar{\alpha}}$$

$$\Rightarrow g^* = H_g^{-1}\left(\frac{1 + \theta}{\bar{\alpha}}\right)$$

Which is the social welfare desired by average citizen.

### 4.3 Electoral competition

#### 4.3.1 Who will become the pivotal voter?

Clearly, the voter with the median  $z$  instead of with median income would be pivotal.

It is true that policy preference satisfy the single crossing property in terms of  $Z^i$ ,

If  $g > g'$  and  $Z^{i'} < Z^i$ , or if  $g < g'$  and  $Z^{i'} > Z^i$ , then

$$w^i(g) \geq w^i(g') \Rightarrow w^{i'}(g) \geq w^{i'}(g') \quad (3)$$

And the Condorcet winner (a policy  $G$  that beats any other feasible policy in a pair wise vote) coincides with the bliss point of the voter with the median value of  $z$ .

We label the median value of  $Z^i$  as  $z^m$ , then by (3) every voter with  $z^i \geq z^m$  prefers  $g(z^m)$  to any  $g < g(z^m)$ . similarly, everyone with  $z^i \leq z^m$  prefers  $g(z^m)$  to any  $g > g(z^m)$ . in other words,  $g(z^m)$  wins a pairwise vote against any conceivable alternative.

From the above analysis we can see clearly what happened after we involved individual's intention of consuming the public goods into the model by comparing it with the standard model.

In the standard model, every citizen values the public goods as the same, each type  $i$  has the same basic and quasi-linear preferences over publicly provide goods  $g$ . the only difference among individuals is the income  $y$ , and which is the only factor affect individual's voting decision, thus the pivotal voter is the voter with median income.

In the framework we illustrate above, we take people's intention to consume the public goods ( $\alpha$ ) into account, the government provision for the public goods now is influenced by the terms of income-intention ratio  $\frac{y_i}{\alpha_i}$ . And the pivotal voter is no longer necessarily the voter with median  $y$  since  $\alpha$  will affect the ordering of  $z$  among the whole population (in the case every individual has the same intention to consume the public goods,  $\alpha$  is the same, then the ordering of  $y$  and  $z$  would be the same, and the voter with the median  $z$  is the same person with the median income) and the individual with median  $z$  would be pivotal.

### 4.3.2 Electoral analysis

The probability of winning the election for the candidate of the party  $p$  is denoted by  $p_p$ . Each party will try to enhance its chance to win the election. The voters will vote for the candidate whose policy will give them higher utility according to their diverse income-intention ratio  $z$ . Candidates have to choose which voters to please to make sure the vote share is bigger than  $1/2$ .

Voters vote for the candidate A only if  $w^i(g_A) > w^i(g_B)$

We have

$$p_A = \begin{cases} 0 & \text{if } w^i(g_A) < w^i(g_B) \\ \frac{1}{2} & \text{if } w^i(g_A) = w^i(g_B) \\ 1 & \text{if } w^i(g_A) > w^i(g_B) \end{cases}$$

The voter with median  $z$  whom I shall call the pivotal voter below plays an essential role. Whenever the pivotal voter prefers one policy to the other, there are at least half of the voters will have the same preference. To see it more clearly let suppose  $z^m$  values  $g_A$  more than  $g_B$ . Then every  $z^i$  with  $z^i < z^m$  will do the same, as from (4),  $g^i$  is decreasing in  $z^i$ . Every voter prefers a larger government. Thus, at least half of the voters will vote for  $g_A$  in this case, the only solution for both of the candidates to increase their opportunity of winning the election is to coverage to the policy that preferred by the pivotal voter, that is  $g_A = g_B = g_m$ .

Here we get the equilibrium policy as

$$g^e = H_g^{-1}\left(\frac{(1 + \theta)}{y} \cdot z^m\right)$$

Or more precisely, the equilibrium policy is the policy favored by the voter with median income-intention ration  $z$ .

### 4.4 How much does the equilibrium solution differ from the first best result?

The first best policy is in the perspective of the average citizen, reflecting the social optimal preference, and the equilibrium result is the solution for neither of the parties can do any change of the policies to get a higher expected rent. It is natural to capture our attention to have a deep look at the difference between these two. Will the equilibrium result be far away from the social optimal solution? And how much is it?

From (8) and (9), we obtain

$$g^* - g^e = H_g^{-1}\left(\frac{1+\theta}{\bar{\alpha}}\right) - H_g^{-1}\left(\frac{(1+\theta)}{y}z^m\right)$$

Let's denote  $H_g^{-1}(\cdot) = h$

According to the mean value theorem  $f(a) - f(b) = (a - b)f'(v)$

$$\begin{aligned} g^* - g^e &= h\left(\frac{1+\theta}{\bar{\alpha}}\right) - h\left(\frac{(1+\theta)}{y}z^m\right) \\ &= \left(\frac{1+\theta}{\bar{\alpha}} - \frac{(1+\theta)}{y}z^m\right)h'(v) \\ &= (1+\theta)\left(\frac{1}{\bar{\alpha}} - \frac{z^m}{y}\right)h'(v) \end{aligned}$$

Note that  $h' < 0$ , when  $v \in \left[\frac{1+\theta}{\bar{\alpha}}, \frac{(1+\theta)}{y} \cdot z^m\right]$

If  $\frac{1}{\bar{\alpha}}$  is different from  $\frac{z^m}{y}$ , we are moving further away

If

$$\frac{1}{\bar{\alpha}} - \frac{z^m}{y} < 0 \Rightarrow \frac{z^m}{y} > \frac{1}{\bar{\alpha}} \Rightarrow z^m > \frac{y}{\bar{\alpha}}$$

which means

$$\left[\frac{y^i}{\alpha^i}\right]^m > \left[\frac{E(y^i)}{E(\alpha^i)}\right]^m$$

Note that  $[ \ ]^m$  means the median value

Then

$$g^* - g^e = (1+\theta)\left(\frac{1}{\bar{\alpha}} - \frac{z^m}{y}\right)h'(v) > 0$$

above expression increasing in  $\theta$

If

$$\frac{1}{\bar{\alpha}} - \frac{z^m}{y} > 0 \Rightarrow \frac{z^m}{y} < \frac{1}{\bar{\alpha}} \Rightarrow z^m < \frac{y}{\bar{\alpha}}$$

We get

$$\left[\frac{y^i}{\alpha^i}\right]^m < \left[\frac{E(y^i)}{E(\alpha^i)}\right]^m$$

Then

$$g^* - g^e = (1 + \theta) \left( \frac{1}{\bar{\alpha}} - \frac{z^m}{y} \right) h'(v) < 0$$

and decreasing in  $\theta$ .

From above analysis, we can get that the distance between the policy preferred by the economy and the pivotal voter is crucially affected by the cost for providing the publicly provided goods. When  $\theta$  increases, the difference become small, in contract, the difference will be large.

When the median value of income-intention ration is bigger than the median value of expectation of income over expectation of intention, the first best redistribution policy will be larger than the equilibrium one, vice versa.

Let's take a look at the extent of the affection of  $\theta$  on  $g^* - g^e$

Differentiate  $g^*$  and  $g^e$  w.r.t.  $\theta$  respectively,

$$\frac{dg^*}{d\theta} < 0$$

$$\frac{dg^e}{d\theta} < 0$$

Which means when the cost increases, individuals get less from the redistribution policy. The reason is obvious, government collects tax to provide publicly provided goods, the increment of the transaction cost will reduce the government's budget for redistribution, and individuals will get less.

However, these two terms do not decrease on the some speed. One of them should be decreasing faster than the other, which means the cost has more affection on one than the other, otherwise, the difference between  $g^*$  and  $g^e$  will be constant.

As we now know that  $g^* - g^e$ ,  $g^*$  and  $g^e$  are all decreasing in  $\theta$  in the case

$$\left[ \frac{y^i}{\alpha^i} \right]^m < \left[ \frac{E(y^i)}{E(\alpha^i)} \right]^m$$

So when the transaction cost increases, both the economy and the pivotal voter get higher  $g$ . Meanwhile,  $g^*$  and  $g^e$  move close to each other. In this circumstance, the result is better for all sides.

## 4.5 Comparative statics on $\alpha$

So far we have got the formalized form of the equilibrium policy and the first best policy in the case we included  $\alpha$  into the model, therefore it follows immediately that how  $\alpha$  will affect the above terms. Let's consider a case with  $n$  citizens. Suppose we increase every citizen's  $\alpha$  by the same margin, the ordering of  $z^i$  will not change as  $z^i = \frac{y^i}{\alpha^i}$  and the position of the pivotal voter remains the same. However, the equilibrium policy will be affected in the following process.

As  $g^e = H_g^{-1}(\frac{(1+\theta)}{y} \cdot z^m)$ , When  $\alpha$  increases,  $\frac{(1+\theta)}{y} \cdot z^m$  will decrease, which enlarge  $g^e$  as  $H_g(\cdot)$  is a decreasing function. Thus, when every citizen gets higher intention to consume the publicly provided goods, the electoral outcome reflects that. Now, we will go to the case when just a proportion of the citizens face a higher  $\alpha$ . Suppose that the previous pivotal voter is included in this part then we get the same result as everyone's  $\alpha$  increase, because the pivotal voter is the only factor matters for the candidates' policy decision in our model. But after a while the identity of the pivotal voter will change. For example, we pick an individual with  $z^i > z^m$ , and increase  $\alpha^i$ , he would become the pivotal voter for certain increase and that will increase  $g^e$ . After that, as  $\alpha^i$  keep increasing, he will below the median position and has no influence on  $g^e$  any more. If the individual has  $z^i < z^m$ , his position will move in the adverse way, however, he would be the pivotal voter with a certain value of  $\alpha$  and continually move above the median position as  $\alpha$  increases. From the above analyze, it seems that the model is not very sensitive according the change of  $\alpha$  when we apply it in reality. For instance, if only a section of the poor people get more interested in consuming the publicly provided good, in our model, it won't matter when only the pivotal voter's identity gets affected. It signifies the limitation of electoral structure in capturing such situation.

## 5. Endogenous quality

So far we have discussed the case when quality is given as an exogenous variable, which means individual in the society have no choice on the quality of the public goods they consumed. From the empirical point of view, it is a really common phenomenon that in many societies there is a section of the citizen who is more willing to consume the public good from the private market. It will make the model more close to the reality when the private manufacturer gets involved. Moreover as we introduce the endogenous quality, the results we get from the previous section are also affected. In this section, we are particularly interested to capture these changes. Though the following discussion, we will exam the case when we introduce quality as an endogenous variable into the model.

### 5.1 Framework

Suppose the government  $G$  provides the public goods with the quality  $q^g$ . For simplicity, assume the government provides a fixed quantity of the publicly provided goods (measure at 1). But its quality is a variable and depends on the transaction cost  $\theta$  and the tax rate  $\tau$ . Furthermore, assume that there is an outside manufacture  $M$  who provides the same good but at a price  $p$ . let's denote the quality provide by  $M$  as  $q^m$ . Obviously, in the equilibrium situation, we must have  $q^m > q^g$ , otherwise no one will buy the good in the private market at a price  $p$  in comparison to the publicly provided good which can be obtained freely.

Let  $\mu(q^m)$  captures the manufactures' unit cost of production if its quality is given by  $q^m$ . The proportion of the citizen who consumes the privately provided public goods is denoted as  $\gamma$ .

### 5.2 Analysis

Now our tasks is to solve for the variables we mentioned above  $(q^g, q^m, p, \gamma, \tau)$ .

We are about to do it in the following sequence

1. Solve for  $q^m$  and  $p$ , given  $q^g$ .
2. Together with  $q^g$  and  $q^m$ , we can get  $\gamma$ .
3. Finally solve for  $\tau$  and  $q^g$ .

To solve for  $q^m$  and  $p$ , we first need to derive the demand function for the manufactures  $D(p, q^m)$ .

Each individual has to choose between the goods provided by the government free of charge and the goods provided by M at the price  $p$ . (we should recall that the citizens have to pay the tax irrespective of the choice)

The utility for the citizen with income  $y^i$  consume the publicly provided good is given as

$$(1 - \tau)y^i + \alpha^i H(q^g)$$

The utility for the citizen with income  $y^i$  consume the good at the private market is

$$(1 - \tau)y^i + \alpha^i H(q^m) - p$$

So the individual will consume the good provided by the private manufacture if and only if

$$(1 - \tau)y^i + \alpha^i H(q^m) - p > (1 - \tau)y^i + \alpha^i H(q^g)$$

Or

$$\alpha^i H(q^m) - p > \alpha^i H(q^g)$$

Which is

$$\alpha^i > \frac{p}{H(q^m) - H(q^g)} = \bar{\alpha}$$

Then we can get the following consequences

For all  $\alpha^i < \bar{\alpha}$ , individual will buy goods from G

$\alpha^i > \bar{\alpha}$ , individual will buy goods from M

$\alpha^i = \bar{\alpha}$ , there will be no difference between these two

Now we need to make some assumption about the distribution of  $\alpha$ . For simplicity, let's take  $\alpha \sim U(0,1)$ . (This assumption is made for simplicity of our result, however, it can be relaxed to some extent)

Then

$$\gamma = \text{prob}[1 > \bar{\alpha}] = 1 - \alpha = 1 - \frac{p}{H(q^m) - H(q^g)}$$

So we can derived M's profit as

$$\pi = p(1 - \frac{p}{H(q^m) - H(q^g)}) - \mu(q^m)(1 - \frac{p}{H(q^m) - H(q^g)})$$

The first term of the expression captures the total revenue which is the price times the proportion of people who buys good from the private manufacture, and the last term is the total cost occurred by providing the privately provided public good.

Then we should find the optimal  $p$  and  $q^m$  to maximize  $\pi$  and solve the above complicated expression sequentially.

First, hold  $q^m$  fixed and solve for  $p$  as a function of  $m$ .

$$p = \text{argmax} \left[ p(1 - \frac{p}{H(q^m) - H(q^g)}) - \mu(q^m)(1 - \frac{p}{H(q^m) - H(q^g)}) \right]$$



According to the first order condition

$$1 - \frac{2p}{H(q^m) - H(q^g)} + \frac{\mu(q^m)}{H(q^m) - H(q^g)} = 0$$

Arrange it as

$$H(q^m) - H(q^g) + \mu(q^m) = 2p$$

We can get

$$p = \frac{H(q^m) - H(q^g) + \mu(q^m)}{2}$$

Second, find  $q^m$  that maximize  $\pi$  according to  $p$  which we just obtained.

$$\begin{aligned} q^m &= \operatorname{argmax} (p - \mu(q^m)(1 - \frac{p}{H(q^m) - H(q^g)})) \\ &= \operatorname{argmax} \left[ \frac{H(q^m) - H(q^g) + \mu(q^m)}{2} - \mu \right] \cdot \left[ 1 - \frac{H(q^m) - H(q^g) + \mu(q^m)}{2[H(q^m) - H(q^g)]} \right] \\ &= \operatorname{argmax} \left[ \frac{H(q^m) - H(q^g) - \mu(q^m)}{2} \right] \cdot \left[ \frac{H(q^m) - H(q^g) - \mu(q^m)}{2[H(q^m) - H(q^g)]} \right] \end{aligned}$$

Then we obtain the optimal

$$q^m = \operatorname{argmax} \frac{[H(q^m) - H(q^g) - \mu(q^m)]^2}{4[H(q^m) - H(q^g)]}$$

So far, it is impossible for us to get a closed form solution unless we know a functional form of  $H(\cdot)$ . However, we can find some comparative statics and derive properties of the solution even without expressing it in closed form. So we define the function as

$$\Delta(q^m, q^g) = \frac{[H(q^m) - H(q^g) - \mu(q^m)]^2}{4[H(q^m) - H(q^g)]}$$

Under certain condition, it can be show that  $\Delta(q^m, q^g)$  is concave, so there exists a unique  $q^m$  that maximize  $\Delta(q^m, q^g)$ .

Two conditions must apply

1.  $q^m > q^g$
2.  $H(q^m) - H(q^g) > \mu(q^m)$

Condition 2 holds otherwise the demand will be negative which is not realistic.

We note the optimal value of  $q^m$  as  $q_e^m = \operatorname{argmax} \Delta(q^m, q^g)$

Meanwhile, the optimal

$$\begin{aligned}
p &= p^e = \frac{H(q^m) - H(q^g) + \mu(q^m)}{2} \\
\gamma &= 1 - \bar{\alpha} = 1 - \frac{p^e}{H(q^m) - H(q^g)} \\
&= 1 - \frac{H(q^m) - H(q^g) + \mu(q^m)}{2[H(q^m) - H(q^g)]} \\
&= \frac{H(q^m) - H(q^g) - \mu(q^m)}{2[H(q^m) - H(q^g)]} \\
&= \frac{1}{2} - \frac{\mu(q^m)}{2[H(q^m) - H(q^g)]}
\end{aligned}$$

Till now we have finished the first two tasks, and next we are going to solve for  $q^g$  and  $\tau$ .

Given  $\tau^e$ , the equilibrium  $q^g$  is

$$q_e^g = \frac{\tau^e y}{1 + \theta}$$

Next we have to solve for  $\tau^e$  to complete the equilibrium specification.

$\tau^e$  will be determined through the electoral competition. As we analyzed before, both parties will converge to the tax rate preferred by the pivotal voter in the equilibrium situation.

Here We should note that finding the most preferred tax rate is equivalent of finding the most preferred  $q^g$ , since there is an one to one relationship between  $q^g$  and  $\tau$ . ( $q^g = \frac{\tau^e y}{1 + \theta}$ )

Let's recall what we did in the previous section when every citizen is getting the goods provided by the government. Then the individual's most preferred amount of goods is obtained

as

$$\begin{aligned}
-\frac{(1 + \theta)y^i}{y} + \alpha^i H_g(g) &= 0 \\
g^i &= H_g^{-1}\left(\frac{(1 + \theta)}{y} \cdot \frac{y^i}{\alpha^i}\right)
\end{aligned}$$

In the current circumstance, part of the citizen will buy the public goods from the private market, which means  $\alpha^i \geq \bar{\alpha}$ . For this people, what is the most preferred amount of  $g$ ?

Let's start from maximizing individual i's utility

$$\max \left( 1 - \frac{(1 + \theta)g}{y} \right) y^i + \alpha^i H(q^m) - p$$

According the first order condition

$$-\frac{1 + \theta}{y} y^i + \frac{d}{dg} [\alpha^i H(q^m) - p] = 0$$

Let's denote the solution by  $g_i^{**}$ , it's obvious that  $g_i^{**} < g_i^*$  because a part of citizen is willing to buy the goods from the private market now, the most preferred amount of the public goods from G should less than the one in the case where there are no privately provided public goods.

We can also see that  $g^e$  is expected to be lower than the one predicted in our previous analysis in another way. Assume, if possible  $g_i^{**} > g_i^*$ , these people would prefer the quality provided by G better than what they would have preferred in case they would consume the good provided by G. However, they consume the goods provided by M. so choosing the quality level better than  $g^*$  is not optimal for people with  $\alpha^i \geq \bar{\alpha}$ . Therefore, for the people who consume the goods provided by G will prefer  $g_i^*$ . For those who consume the good provided by M would prefer  $g_i^{**} < g_i^*$ . Hence, the median voter in this case will prefer (weakly) a quality  $q^e$  which is less than the quality if everyone consumes the good provided by G. So  $g^e$  is expected to be lower than the one predicted in our previous analysis.

## 6. Conclusion

The thesis addresses to explain the redistribution puzzle in the area of political economics. Many empirical studies show that the redistribution level is often lower than which is predicted by the standard model. I review some of the literatures concerning the extent of redistribution. To begin with, Persson and Tabellini provide a standard framework of the electoral model of redistribution. The model predicts a positive relationship between income inequality and the extent of redistribution. This result makes sense in the perspective of smoothing inequality of the society, however, doesn't necessarily match the empirical data.

Researchers have tried various approaches to explain the limits to redistribution. There are several factors that may affect the extent of redistribution. One of the explanations is that the rich majority instead of the poor control the political process. For instance, the rich can access more accurate political information than the poor because of higher education or their lobbying power or being in influential network. They will therefore be weighted more in the electoral competition. In such a scenario, the political process is more likely to implement the policy with low extent of redistribution that is preferred by the rich. Electoral competition over multidimensional policy space provides us another explanation. With several issues in consideration, voters' preference over tax rates could be very different from the tax rate that may arise in an electoral competition based only on redistributive tax over income. Moreover, people's expectation about the future can also affect the redistribution policy. For instance, if the voter expects to earn an income greater than the average in the future, there may be a preference for modest redistribution even if her current income is low. Some scholars focus on the case when the distribution policy can be targeted on some special groups, such as unemployed people, old people etc.

My thesis tries to provide another explanation. The standard model assumes that the all individuals value the publicly provided goods the same way and the quality of the publicly provided goods is exogenously given. In the model I described, I relax these assumptions. First, I consider the case in which individuals may have different preference over the publicly provided good. I capture this heterogeneity in preference by introducing a new parameter, which I call the intensity to consume the good. I assume that the intensity to consume differs across individuals. I find that the redistribution policy preferred by an individual now depends on the ratio of income and the intensity to consume the good. Unlike the standard model, the

electoral competition shows that the pivotal voter is no longer the voter with the median income, but the voter with median income-intention ratio. I also find that the transaction cost that the government incurs to provide public good is an important determinant of both the optimal tax rate as well as the equilibrium tax rate determined in electoral competition. However, the difference between the two can go in either direction as the level of transaction cost changes. The result signifies the importance of institutional parameters in various democracies to characterize the difference in their electoral outcomes.

We next extend our model to capture the situation in which the government is not necessarily the only supplier of the publicly provided goods. The standard models consider the government as a sole distributor of the public good. Unlike these models, we consider existence of a private manufacturer who sells a substitute of the public good. The good supplied by the private manufacturer is different from the publicly provided good in quality. Some people then turn to purchase the good from the private market due to the different quality. In equilibrium, the quality provided by the private manufacturer is higher than the quality provided by the government. I find that the existence of privately provided public goods can further limit the willingness to consume publicly provided good.

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